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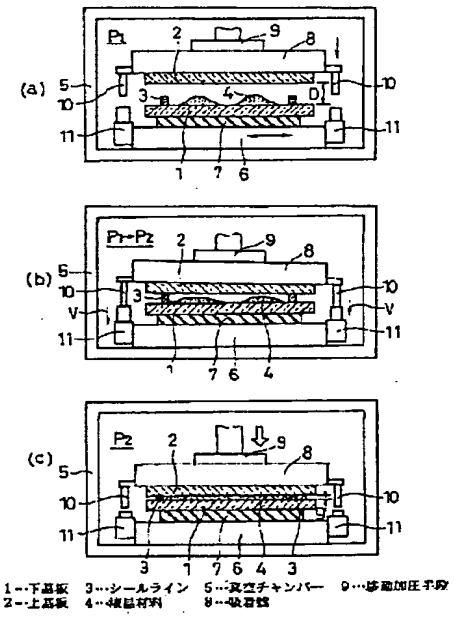
(54) METHOD OF LAMINATING LIQUID CRYSTAL SUBSTRATES

(57) Abstract:

PROBLEM TO BE SOLVED: To laminate the upper substrate and lower substrate with high produc tivity, free from mixing bubbles into the gap between the lower substrate and the upper substrate.

SOLUTION: Liquid crystal material 4 is dropped in the space surrounded by an annular seal-line 3 on the lower substrate 1 which is arranged in the vacuum chamber 5 where the upper substrate 2 is laid facing to the lower substrate 1 by means of vacuum-chucking. At least one of the substrates is moved toward the other substrate and pressurized to laminate keeping the inside of the vacuum chamber 5 in a vacuum-exhaust state. This method has the ability not only to prevent the introduction of air bubbles into the gap but also to vacuum chucking the upper substrate 2 reliably using a short- duration vacuum exhausting means by making the inside of the vacuum chamber 5 under pressure of 50-400 Pa.



Notes:
1. Untranslatable words are replaced with asterisks (****).
2. Texts in the figures are not translated and shown as it is.

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FULL CONTENTS

[Claim(s)]

[Claim 1] A liquid crystal material is dropped at the space surrounded in the annular seal line on a lower substrate. Arrange this lower substrate in a vacuum chamber, carry out vacuum absorption of the upper substrate within a vacuum chamber, and a placed opposite is carried out on a lower substrate. The lamination method of the liquid crystal substrate which changes the inside of a vacuum chamber into a 50-400Pa pressure state, and is characterized by turning and moving at least one substrate to the other party, pressurizing, and sticking both substrates.

[Claim 2] A liquid crystal material is dropped at the space surrounded in the annular seal line on a lower substrate. Arrange this lower substrate in a vacuum chamber, carry out vacuum absorption of the upper substrate within a vacuum chamber, and a placed opposite is carried out on a lower substrate. when evacuation of the inside of a vacuum chamber is carried out, it changes into a predetermined pressure state and the one end side of the Gokami substrate contacts a seal line, the other end side of an upper substrate receives a seal line -- predetermined spacing bitter taste -- [at least one substrate is turned and moved to the other party, and it pressurizes, and] so that it may pass through the state where the upper substrate inclined like The lamination method of the liquid crystal substrate characterized by sticking both substrates.

[Claim 3] The lamination method of the liquid crystal substrate according to claim 2 characterized by changing the inside of a vacuum chamber into a 50-400Pa pressure state, and performing migration and application of pressure of a substrate.

[Claim 4] When the one end side of an upper substrate contacts a seal line, [other end side of an upper substrate] between seal lines The lamination method of the liquid crystal substrate according to claim 2 or 3 characterized by making it spacing of 100-1000 micrometers arise, regulating the both ends of a substrate after that so that the traveling speed may not exceed sec in 30-300micrometers /, and performing migration and application of pressure.

[Claim 5] On a lower substrate, the height of t and a seal line is set to T for the restoration depth of a liquid crystal material. Form the annular seal line of the height of the range of $t<T<4t$, and the lower substrate which trickled the liquid crystal material into the space

surrounded in the seal line is arranged in a vacuum chamber. The lamination method of the liquid crystal substrate which carries out vacuum absorption of the upper substrate within a vacuum chamber, and is characterized by carrying out a placed opposite, carrying out evacuation of the inside of a vacuum chamber, changing into a predetermined pressure state, making the other party turn and move at least one substrate onto a lower substrate, pressurizing, and sticking both substrates.

[Claim 6] The lamination method of the liquid crystal substrate according to claim 5 characterized by changing the inside of a vacuum chamber into a 50-400Pa pressure state, and performing migration and application of pressure of a substrate.

[Claim 7] when the one end side of an upper substrate contacts a seal line, the other end side of an upper substrate receives a seal line -- predetermined spacing bitter taste -- [at least one substrate is turned and moved to the other party, and it pressurizes, and] so that it may pass through the state where the upper substrate inclined like The lamination method of the liquid crystal substrate according to claim 5 or 6 characterized by sticking both substrates.

[Claim 8] A liquid crystal material is dropped at the space surrounded in the annular seal line on a lower substrate. Arrange this lower substrate in a vacuum chamber, carry out vacuum absorption of the upper substrate within a vacuum chamber, and a placed opposite is carried out on a lower substrate. Carry out evacuation of the inside of a vacuum chamber, change into the 1st predetermined pressure state, and at least one substrate is turned and moved to the other party after that. The lamination method of the liquid crystal substrate which carries out evacuation of the inside of a vacuum chamber further, changes into the 2nd predetermined pressure state lower than the 1st predetermined pressure, and is characterized by pressurizing both substrates and sticking both substrates after a part of upper substrate [at least] approaches or contacts the seal line of a lower substrate.

[Claim 9] The 1st predetermined pressure is the lamination method of the liquid crystal substrate according to claim 8 characterized by being referred to as 50-400Pa, and the 2nd predetermined pressure being 10-50Pa.

[Claim 10] The lamination method of the liquid crystal substrate according to claim 8 or 9 characterized by setting the height of t and a seal line to T for the restoration depth of a liquid crystal material, and forming the annular seal line of the height of the range of $t<T<4t$ on a lower substrate.

[Claim 11] when the one end side of an upper substrate contacts a seal line, the other end side of an upper substrate receives a seal line -- predetermined spacing bitter taste -- [at least one substrate is turned and moved to the other party, and it pressurizes, and] so that it may pass through the state where the upper substrate inclined like The lamination method of a liquid crystal substrate given in any of Claim 8 -10 characterized by sticking both substrates they are.

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the lamination method of the liquid crystal substrate which sticks the substrate which constitutes the liquid crystal panel in a liquid crystal display.

[0002]

[Description of the Prior Art] The liquid crystal panel in a liquid crystal display maintains and carries out the placed opposite of the predetermined gap of about 5 micrometers among them through the annular seal line which consists of UV cure adhesive etc. between the lower substrate and upper substrate which consist of translucency ingredients, such as a glass substrate. It is filled up with a liquid crystal material in the gap surrounded in the seal line, and is constituted.

[0003] thus, as a method of sticking a lower substrate and an upper substrate, where the gap between a lower substrate and an upper substrate is filled up with a liquid crystal material Apply adhesives on a lower substrate and 1 or two or more annular seal lines are formed. A liquid crystal material is dropped at the interior of the space surrounded in the seal line, subsequently to the upper part arrange an upper substrate, and alignment (alignment) of an upper substrate and a lower substrate is performed. It pressurizes until it piles up the Gokami substrate and lower substrate and spacing between an upper substrate and a lower substrate becomes a specified gap, and the liquid crystal dropping method of irradiating ultraviolet rays and stiffening the adhesives of a seal line is indicated, for example in JP,H10-333157,A etc.

[0004] About the example of such a liquid crystal substrate lamination method, the method indicated by JP,2000-137235,A is explained with reference to drawing 4 . First, as shown in drawing 4 (a), apply to a top face annularly the sealant which consists of UV cure adhesive at 30 micrometers in thickness, and the annular seal line 23 is formed in it. [the lower substrate 21 which trickled the liquid crystal material 24 into the space surrounded in the seal line 23] Installation immobilization is carried out through the elastic spacer 27 on the positioning table 26 in the vacuum chamber 25. On the other hand, vacuum absorption of the upper substrate 22 is carried out with an adhesive disk 28, it opens and carries out the placed opposite of the spacing of about 0.5mm to the upper part of a lower substrate 21, justifies the positioning table 26 horizontally in the state, and performs alignment of a lower substrate 21 and an upper substrate 22.

[0005] [next, the state where carried out evacuation of the inside of the vacuum chamber 25, for example, it held in atmosphere pressure of 100Pa or less so that air bubbles might not mix in a gap] Carry out descending movement of the adhesive disk 28 by the force means 29, turn an upper substrate 22 to a lower substrate 21, and it is made to move perpendicularly, it pressurizes until the gap g between a lower substrate 21 and an upper substrate 22 is set to 5 micrometers, as shown in drawing 4 (b), and a lower substrate 21 and an upper substrate 22 are stuck. Then, ultraviolet rays are irradiated, a seal line 23 is stiffened, and lamination is completed.

[0006] [in addition, the gap g between the lower substrate 21 and upper substrate 22 as which a submicron precision is required] It is regulated with the fiber with which the postspacer which protruded on Beith who intervened between the lower substrate 21 and

the upper substrate 22, or a lower substrate 21, and the adhesives of the seal line 23 were filled up. Moreover, the elastic spacer 27 has contributed to it being concerned with the flatness of a lower substrate 21, an upper substrate 22, the positioning table 26, and an adhesive disk 28, and securing the precision of the above-mentioned predetermined gap g by application of pressure that there is nothing.

[0007]

[Problem(s) to be Solved by the Invention] However, since the inside of the vacuum chamber 25 is changed into the pressure state of 100Pa or less as mentioned above in order to prevent mixing of air bubbles, There is only the about 80Pa differential pressure as for about 20-30Pa about the adsorptive pressure in an adhesive disk 28. Since the adsorption power of an upper substrate 22 was small, while working, the upper substrate 22 fell to the contingency, and there was a problem that there was a possibility of treatment processes, such as detailed thin film formation, being performed, and damaging very expensive upper substrate 22 and lower substrate 21.

[0008] On the other hand, although making the adsorptive pressure of an adhesive disk 28 still lower is also considered Making the adsorption face of an adhesive disk 28 and flatness of an upper substrate 22 high beyond the actual condition will require time amount, before making it a predetermined pressure, while it is actually impossible when commercializing, therefore equipment enlarges a pressure to make it low, and there is a problem of reducing productivity remarkably. Moreover, although replacing with vacuum absorption and applying electrostatic adsorption is also considered, there is a problem that electrostatic adsorption has an adverse effect on the component on a substrate, or there is a possibility that static electricity may have an adverse effect at the process which follows, an applicable substrate is restricted, and it does not have versatility.

[0009] This invention aims at offering the lamination method of the liquid crystal substrate which productivity is good fearlessly and can stick an upper substrate and a lower substrate which mixes air bubbles in the gap between a lower substrate and an upper substrate in view of the above-mentioned conventional problem.

[0010]

[Means for Solving the Problem] The lamination method of the liquid crystal substrate of this invention trickles a liquid crystal material into the space surrounded in the annular seal line on a lower substrate. Arrange this lower substrate in a vacuum chamber, carry out vacuum absorption of the upper substrate within a vacuum chamber, and a placed opposite is carried out on a lower substrate. Change the inside of a vacuum chamber into a 50-400Pa pressure state, turn and move at least one substrate to the other party, and it pressurizes. By sticking both substrates and limiting the pressure state in a vacuum chamber to 50-400Pa [a thing] even if it sets it as about 20-30Pa which can prevent, and can attain the adsorption pressure of an upper substrate in a short time be [the flatness of an upper substrate and an adhesive disk / present / continue] that air bubbles mix in a gap Adsorption maintenance of the upper substrate can be carried out with high dependability, and a liquid crystal substrate with sufficient image display quality can be manufactured with sufficient productivity.

[0011] Moreover, a liquid crystal material is dropped at the space surrounded in the annular seal line on a lower substrate. Arrange this lower substrate in a vacuum chamber, carry out vacuum absorption of the upper substrate within a vacuum chamber, and a placed opposite is carried out on a lower substrate. when evacuation of the inside of a vacuum chamber is carried out, it changes into a predetermined pressure state and the one end side of the Gokami substrate contacts a seal line, the other end side of an upper substrate receives a seal line -- predetermined spacing bitter taste -- [at least one substrate is turned and moved to the other party, and it pressurizes, and] so that it may pass through the state where the upper substrate inclined like Since it will pressurize losing the dip after contacting with the position toward which the upper substrate inclined to the lower substrate if both substrates are stuck It can stick extruding the air bubbles which may be mixed in a gap from the one end side to the other end side, even if the pressure in a vacuum chamber is high to some extent, mixing of the air bubbles into a gap can be prevented, and a liquid crystal substrate with sufficient image display quality can be manufactured with sufficient productivity.

[0012] When the pressure state in a vacuum chamber shall be 50-400Pa as mentioned above and migration and application of pressure of a substrate are performed here, mixing of air bubbles can be prevented further and it is desirable. Moreover, when the one end side of an upper substrate contacts a seal line, [other end side of an upper substrate] between seal lines It is made for spacing of 100-1000 micrometers to arise, and if the both ends of a substrate are regulated so that the traveling speed may not exceed sec in 30-300micrometers /, and migration and application of pressure are performed after that, the mixing preventive effect of the above-mentioned air bubbles will be acquired certainly.

[0013] Moreover, the height of t and a seal line is set to T for the restoration depth of a liquid crystal material on a lower substrate. Form the annular seal line of the height of the range of $t<T<4t$, and the lower substrate which trickled the liquid crystal material into the space surrounded in the seal line is arranged in a vacuum chamber. If vacuum absorption of the upper substrate is carried out within a vacuum chamber, carry out a placed opposite on a lower substrate, carry out evacuation of the inside of a vacuum chamber, and it changes into a predetermined pressure state, and at least one substrate is turned and moved to the other party, it pressurizes and both substrates are stuck [an upper substrate] by having limited the height dimension of the seal line low where a seal line is contacted Space volume between an upper substrate and a liquid crystal material can be made small, the part air with which there are few air contents made to escape from a seal line at the time of the part application of pressure, and they can be managed cannot remain easily, mixing of the air bubbles into a gap can be prevented, and a liquid crystal substrate with sufficient image display quality can be manufactured with sufficient productivity.

[0014] When the pressure state in a vacuum chamber shall be 50-400Pa as mentioned above and migration and application of pressure of a substrate are performed here, mixing of air bubbles can be prevented further and it is desirable. moreover -- when the one end side of an upper substrate contacts a seal line, the other end side of an upper substrate receives a seal line -- predetermined spacing bitter taste -- [at least one substrate is turned

and moved to the other party, and it pressurizes and] so that it may pass through the state where the upper substrate inclined like When both substrates are stuck, the air bubbles which may be mixed in a gap can be extruded from the one end side to the other end side, mixing of the air bubbles into a gap can be prevented further, and it is desirable.

[0015] Moreover, a liquid crystal material is dropped at the space surrounded in the annular seal line on a lower substrate. Arrange this lower substrate in a vacuum chamber, carry out vacuum absorption of the upper substrate within a vacuum chamber, and a placed opposite is carried out on a lower substrate. Carry out evacuation of the inside of a vacuum chamber, change into the 1st predetermined pressure state, and at least one substrate is turned and moved to the other party after that. If carry out evacuation of the inside of a vacuum chamber further, it changes into the 2nd predetermined pressure state lower than the 1st predetermined pressure, both substrates are pressurized and both substrates are stuck, after a part of upper substrate [at least] approaches or contacts the seal line of a lower substrate After making it move until it carries out adsorption maintenance of the upper substrate certainly in the state of the 1st comparatively high predetermined pressure and contacts a lower substrate, By pressurizing in the state of the 2nd predetermined pressure lower than it, it can prevent certainly that air bubbles mix in a gap, and a liquid crystal substrate with sufficient image display quality can be manufactured with sufficient productivity.

[0016] When the 1st predetermined pressure shall be 50-400Pa and the 2nd predetermined pressure shall be 10-50Pa here, while being able to carry out the adsorption maintenance of the upper substrate certainly in the 1st low predetermined pressure as much as possible, it decompresses promptly in the 2nd predetermined pressure state, mixing of air bubbles can be prevented certainly, and it is desirable. Moreover, when the height of t and a seal line is set to T for the restoration depth of a liquid crystal material and the annular seal line of the height of the range of $t<T<4t$ is formed on a lower substrate, by having limited the height dimension of the seal line low, mixing of the air bubbles into a gap can be prevented further as mentioned above, and it is desirable. moreover -- when the one end side of an upper substrate contacts a seal line, the other end side of an upper substrate receives a seal line -- predetermined spacing bitter taste -- [at least one substrate is turned and moved to the other party, and it pressurizes and] so that it may pass through the state where the upper substrate inclined like When both substrates are stuck, the air bubbles which may be mixed in a gap as mentioned above can be extruded from the one end side to the other end side, mixing of the air bubbles into a gap can be prevented further, and it is desirable.

[0017]

[Embodiment of the Invention] One embodiment of the lamination method of the liquid crystal substrate of this invention is hereafter explained with reference to drawing 1 - drawing 3 .

[0018] The process which manufactures the liquid crystal substrate which fills up with the liquid crystal material 4 the space surrounded in the seal line 3 formed in drawing 1 at the gap g between a lower substrate 1 and an upper substrate 2 is shown. First, as shown in

drawing 1 (a), apply to the top face of a lower substrate 1 annularly the sealant which consists of UV cure adhesive, and the annular seal line 3 is formed in it. The liquid crystal material 4 is dropped at the space surrounded in that seal line 3, and installation immobilization of this lower substrate 1 is carried out through the elastic spacer 7 on the positioning table 6 in the vacuum chamber 5. The positioning table 6 performs horizontal positioning of a lower substrate 1.

[0019] A lower substrate 1 and an upper substrate 2 are 550mm x 670mm in magnitude, and [a lower substrate 1 and an upper substrate 2] According to the number of these substrates 1 and the liquid crystal panels produced by 2, 1 or two or more image display regions (a display cell is called hereafter) are formed, and the annular seal line 3 carries out spreading formation so that the perimeter may be surrounded for every display cell.

[0020] The drip is controlled by accuracy so that the restoration depth of the liquid crystal material 4 is equal to the predetermined gap g, for example, it is set to 5 micrometers for every display cell. In addition, by the viscosity, where the liquid crystal material 4 is dropped, as shown in drawing 1 (a), it assumes Yamagata. [when pressurizing a lower substrate 1 and an upper substrate 2, had applied the seal line 3 so that this liquid crystal material 4 overcame an it top, and might not protrude it into a contingency, and it was necessary to apply in suitable height and might be conventionally set to about 30 micrometers with sufficient allowances but] In this embodiment, it is set as the lowest possible height in the range which the liquid crystal material 4 does not protrude. specifically setting the height of t and a seal line 3 to T for the restoration depth of the liquid crystal material 4, as shown in drawing 2 -- $t<T<4t$ -- suitable -- $2t<T$ -- < -- it is set as 3T. That is, the restoration depth of the liquid crystal material 4 has set suitably 5-20 micrometers of height of a seal line 3 as 10-15 micrometers as 5 micrometers.

[0021] Next, while carrying out vacuum absorption of the upper substrate 2 with an adhesive disk 8 and carrying out insertion arrangement into the vacuum chamber 5, it is the pressure P1 of about 150Pa suitably 50-400Pa about the inside of the vacuum chamber 5. Evacuation is carried out. Even if the adsorption pressure of an adhesive disk 8 does not specialize flatness of the adsorption face of an upper substrate 2 or an adhesive disk 8, it is set as 20-30Pa which is the pressure range which can be attained in a short time. A possibility that an upper substrate 2 can improve [productivity] adsorption maintenance by this, and about 100Pa sufficient pressure differential may be acquired, and the upper substrate 2 which carried out adsorption maintenance may be fallen and damaged in a contingency between the pressures of 50-400Pa in the vacuum chamber 5 by which evacuation was carried out can be abolished.

[0022] Next, by the migration force means 9 which performs the vertical movement of an adhesive disk 8, and the load of welding pressure, with an adhesive disk 8, open the spacing D of about 0.5-1mm in the upper part of a lower substrate 1, and the placed opposite of the upper substrate 2 which carried out adsorption maintenance is carried out to it. The image recognition of the positioning mark prepared in the upper substrate 1 by which the placed opposite was carried out, and the lower substrate 2, respectively is carried out, and the positioning table 6 is justified so that they may be in agreement.

[0023] As the height specification-part material 10 is arranged in the four-corners section of an adhesive disk 8, and the linear actuator 11 of the sliding direction is arranged in the location which counters the height specification-part material 10 of the four-corners section of the positioning table 6, next it is shown in drawing 1 (b) An adhesive disk 8 is dropped until each height specification-part material 10 contacts a linear actuator 11. As each height specification-part material 10 is shown in drawing 3 , the end side of an upper substrate 2 contacts a seal line 3. As for the other end side of an upper substrate 2, adjustment setting of the linear dimension is carried out so that a linear actuator 11 may be contacted, respectively in the state where the upper substrate 2 inclines so that only the predetermined spacing d of about 100 micrometers or more may open as opposed to a lower substrate 1.

[0024] next -- carrying out evacuation of the inside of the vacuum chamber 5 -- the pressure state -- P1 [50-400Pa] from -- P2 [10-50Pa] up to -- a degree of vacuum is raised. Moreover, [carry out motion moving of all the linear actuators 11 about 30-300micrometers/sec in rate / predetermined / V, and / adhesive disk / 8 / an upper substrate 2 / losing the dip from the above-mentioned dip position] It is made to move towards a lower substrate 1, and it pressurizes with predetermined welding pressure until between a lower substrate 1 and upper substrates 2 becomes the predetermined gap g by the migration force means 9 succeedingly, as shown in drawing 1 (c) after that. It is stuck while a lower substrate 1 and an upper substrate 2 extrude the air bubbles which may be mixed in the gap g between them from the one end side to the other end side by this. Then, ultraviolet rays are irradiated, a seal line 3 is stiffened, and the lamination of an upper substrate 2 and a lower substrate 1 is completed.

[0025] [according to the composition of this above embodiment] by limiting the pressure state in the vacuum chamber 5 to 50-400Pa Even if it sets the adsorption pressure of an upper substrate 2 as about 20-30Pa which can be attained in a short time, adsorption maintenance of the upper substrate 2 can be carried out with high dependability, and a liquid crystal substrate can be manufactured with sufficient productivity.

[0026] When [moreover,] the one end side contacts a seal line 3 in an upper substrate 2, and the other end side makes it move so that it may pass through the state where it inclined so that only the predetermined spacing d of 100 micrometers or more might open to a lower substrate 1 and pressurizes towards a lower substrate 1 After contacting with the position toward which the upper substrate 2 inclined to the lower substrate 1, it can pressurize losing the dip. It can stick extruding the air bubbles which may be mixed by it in the gap between a lower substrate 1 and an upper substrate 2 from the one end side to the other end side. Even if the pressure in the vacuum chamber 5 is high to some extent, mixing of the air bubbles into a gap g can be prevented, and a liquid crystal substrate with sufficient image display quality can be manufactured.

[0027] About 100-1000 micrometers is suitable for the predetermined spacing d. In 100 micrometers or less, if welding pressure acts, the elastic spacer 7 infixed between the positioning tables 6 will carry out elastic deformation to a lower substrate 1, and a tilting amount will be offset by the relief by the side of the other end of a lower substrate 1. The

above-mentioned operation is no longer acquired fully, and at 1000 micrometers or more, although migration takes time amount, effectiveness does not improve, but because productivity is reduced, it becomes reverse.

[0028] Moreover, the mixing preventive effect of air bubbles is certainly acquired by regulating the lowering speed V by the linear actuator 11 from a dip position in rate of about 30-300micrometers/sec, and performing migration and application of pressure. Since it is easy to miss air bubbles from each space surrounded in the seal line 3 when there are few substrates 1 and display cells on two, this lowering speed V can be set up highly. On the other hand, since both the substrates 1 and 2 are almost parallel in the substrate 1 and other end side of 2 and it is hard to miss the air bubbles of each space surrounded in the seal line 3 when there are many display cells, it is desirable to set up the lowering speed V low.

[0029] Moreover, since T and the restoration depth of the liquid crystal material 4 were set to t, the height of the seal line 3 on a lower substrate 1 was made into the range of $t<T<4t$ and the height dimension of a seal line 3 is limited low Space volume between an upper substrate 2 and the liquid crystal material 4 can be made small, after the upper substrate 2 has contacted the seal line 3, there are few air contents made to escape from a seal line 3 at the time of the part application of pressure, and they can be managed, the part air cannot remain easily, and mixing of the air bubbles into a gap can be prevented more certainly.

[0030] Furthermore, the inside of the vacuum chamber 5 is changed into a 50-400Pa pressure state as mentioned above. After turning to a lower substrate 1 the upper substrate 2 which carried out adsorption maintenance, making it move with an adhesive disk 8 and a part of upper substrate's [at least] 2 approaching or contacting the seal line 3 of a lower substrate 1, Since carry out evacuation of the inside of the vacuum chamber 5 further, it changes into a 10-50Pa pressure state, both the substrates 1 and 2 are pressurized and it sticks After making it move until it carries out adsorption maintenance of the upper substrate 2 certainly in the state of the pressure of comparatively high 50-400Pa and contacts a lower substrate 1, it can prevent certainly that air bubbles mix in a gap by pressurizing in the state of the pressure of 10-50Pa.

[0031] According to this embodiment, a liquid crystal substrate with sufficient image display quality as mentioned above can be manufactured with sufficient productivity.

[0032] In addition, although an upper substrate 2 is moved to a lower substrate 1 and it was made to pressurize in the above-mentioned embodiment, it cannot be overemphasized that a lower substrate 1 may be moved to reverse to an upper substrate 2, and it may be pressurized. Moreover, after making an upper substrate 2 into a dip position, the height specification-part material 10 and a linear actuator 11 were used as a means stuck with predetermined speed, but it is not limited to it and can constitute giving such a function to the migration force means 9 etc. in arbitration.

[0033] Moreover, [in the above-mentioned embodiment, after limiting the pressure in the vacuum chamber 5 to 50-400Pa, carried out evacuation to the pan to 10-50pa at the time of a pressurizing process, but] By having limited to 50-400Pa, even if it pressurizes both the substrates 1 and 2 and sticks by a pressure as it is, mixing of air bubbles can be prevented.

Moreover, if evacuation is carried out to reverse to 10-50Pa at the time of a pressurizing process by not limiting the pressure in the vacuum chamber 5 till then to 50-400Pa as mentioned above, being alike to this extent and carrying out evacuation, although it may be higher, evacuation can be carried out for a short time to the 10-50Pa pressure state at the time of a pressurizing process, and productivity improves.

[0034] Moreover, also about height definition of the dip lamination of the above-mentioned upper substrate 2, or a seal line 3, even if it carries out independently, respectively, necessary effectiveness can be done so. However, by combining each above technical means suitably, productivity is good and mixing of air bubbles can be prevented more effectively.

[0035]

[Effect of the Invention] [according to the lamination method of the liquid crystal substrate of this invention] by limiting the pressure state in a vacuum chamber to 50-400Pa Even if it sets up so that it can prevent that air bubbles mix in a gap, and the adsorption pressure of an upper substrate can be attained in a short time be [the flatness of an upper substrate and an adhesive disk / present / continue], adsorption maintenance of the upper substrate can be carried out with high dependability.

[0036] Moreover, by pressurizing losing the dip, after contacting an upper substrate with the position which inclined to the lower substrate It can stick extruding the air bubbles which may be mixed in a gap from the one end side to the other end side, and even if the pressure in a vacuum chamber is high to some extent, mixing of the air bubbles into a gap can be prevented.

[0037] After [moreover,] the upper substrate has contacted the seal line by setting the height of t and a seal line to T for the restoration depth of a liquid crystal material, and limiting the height dimension of a seal line to the low value of the range of $t<T<4t$ Space volume between an upper substrate and a liquid crystal material can be made small, the part and air which there are few air contents made to escape from a seal line at the time of application of pressure, and end can make it hard to remain, and mixing of the air bubbles into a gap can be prevented.

[0038] moreover, adsorption maintenance of the upper substrate is certainly carried out in the state of the 1st comparatively high predetermined pressure, and a lower substrate is contacted -- wait -- after making it move, it can prevent certainly that air bubbles mix in a gap by pressurizing in the state of the 2nd predetermined pressure lower than it.

[0039] As mentioned above, according to this invention, a liquid crystal substrate with sufficient image display quality can be manufactured with sufficient productivity by carrying out combining the above-mentioned method independently or suitably.

[Brief Description of the Drawings]

[Drawing 1] It is the sectional view showing the liquid crystal substrate lamination process in one embodiment of this invention.

[Drawing 2] It is the explanatory view of the height dimension of the seal line in this

embodiment.

[Drawing 3] It is the explanatory view of a dip state of the upper substrate in this embodiment.

[Drawing 4] It is the sectional view showing the liquid crystal substrate lamination process of conventional parallel.

[Description of Notations]

1 Lower Substrate

2 Upper Substrate

3 Seal Line

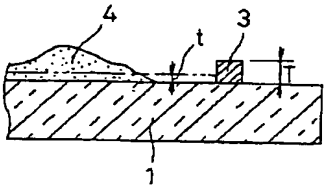
4 Liquid Crystal Material

5 Vacuum Chamber

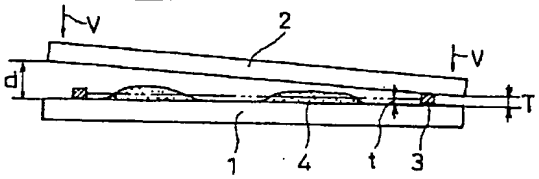
8 Adhesive Disk

9 Migration Force Means

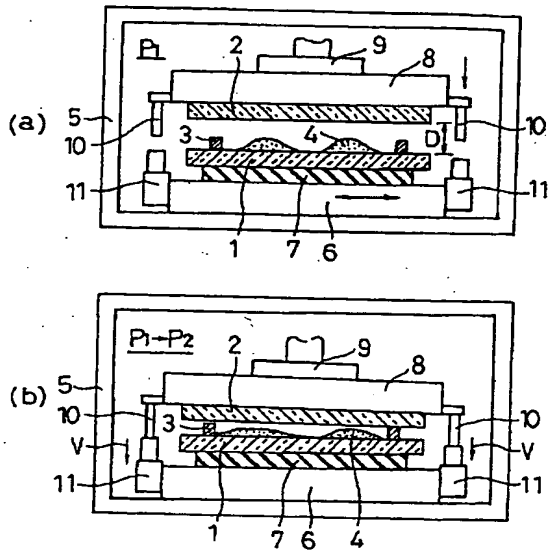
[Drawing 2]



[Drawing 3]

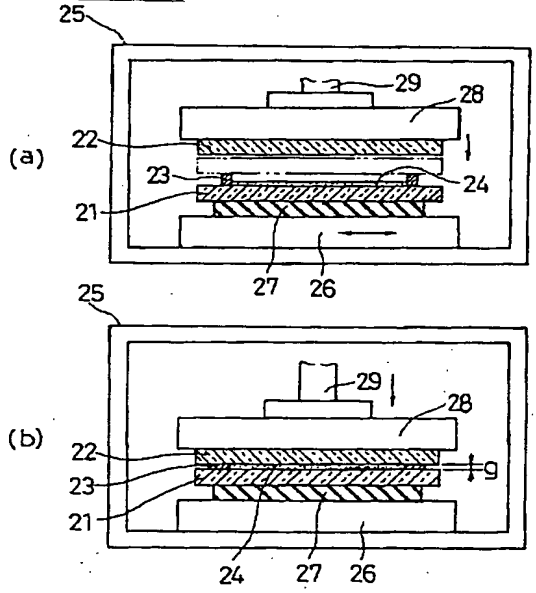


[Drawing 1]



1…下基板　3…シールライン　5…真空チャンバー　9…移動加圧手段
2…上基板　4…液晶材料　8…吸着盤

[Drawing 4]



[Translation done.]